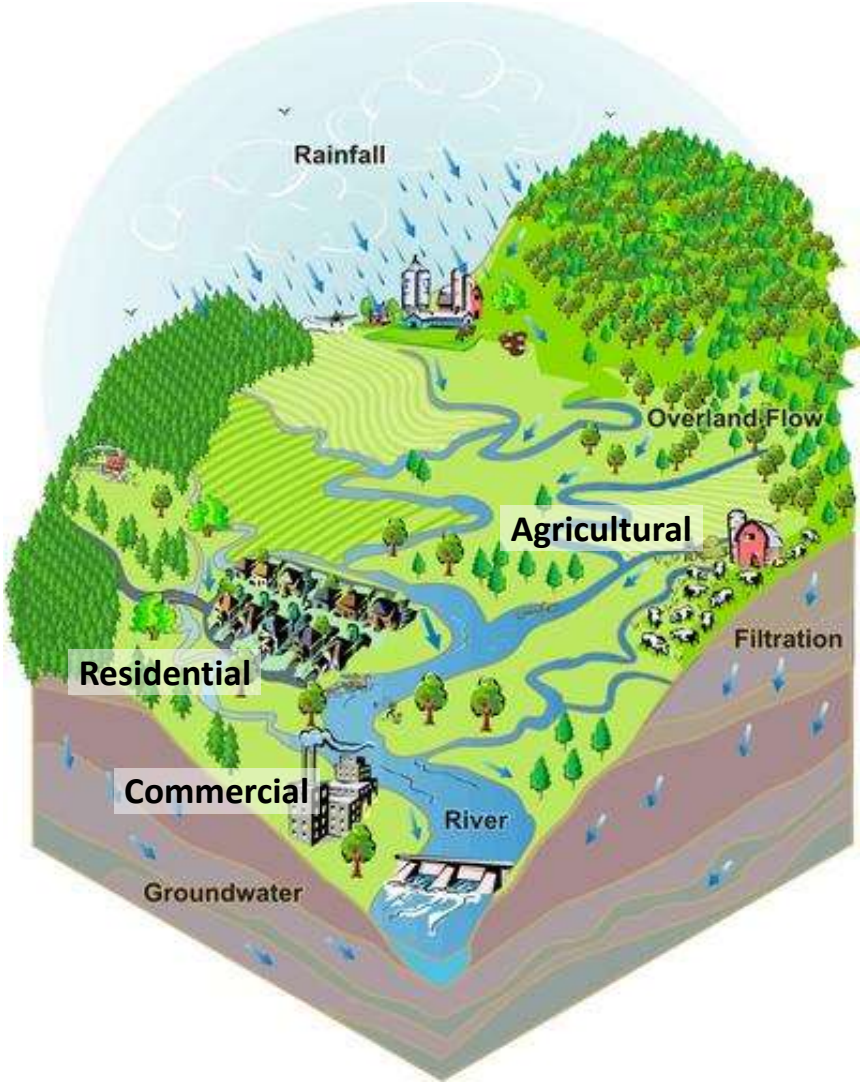
Modeling PCBs in the New River

New River PCB TMDL TAC Meeting

May 26, 2016

What is a model?

A computational representation of a watershed used to simulate pollutant fate and transport.



http://prairierivers.org/what-is-a-watershed/

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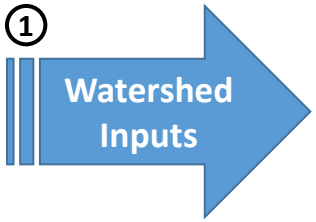

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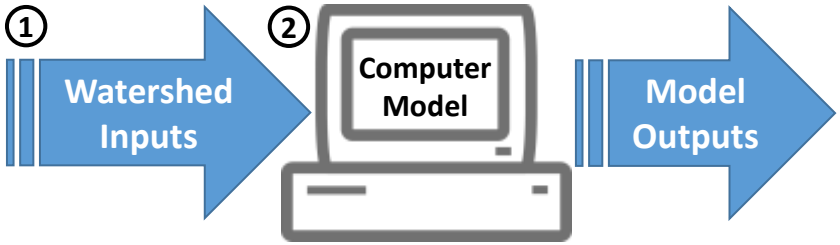

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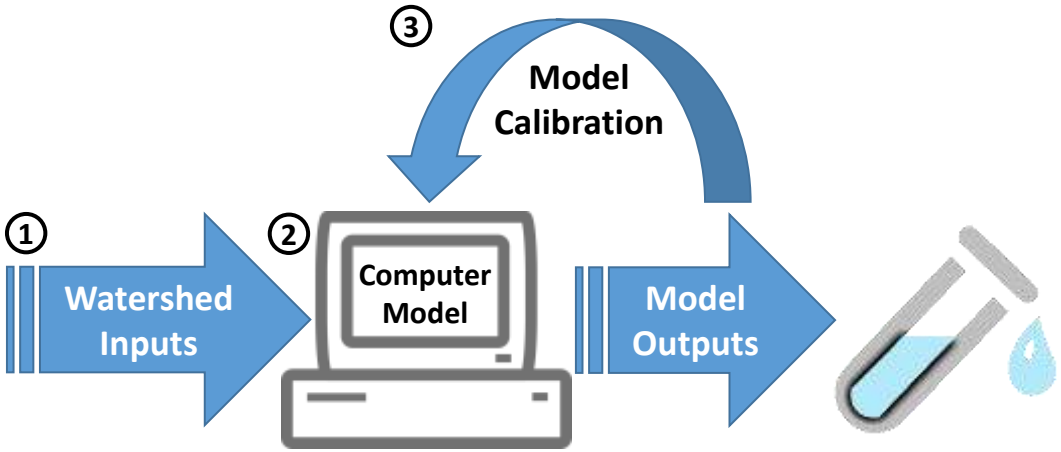

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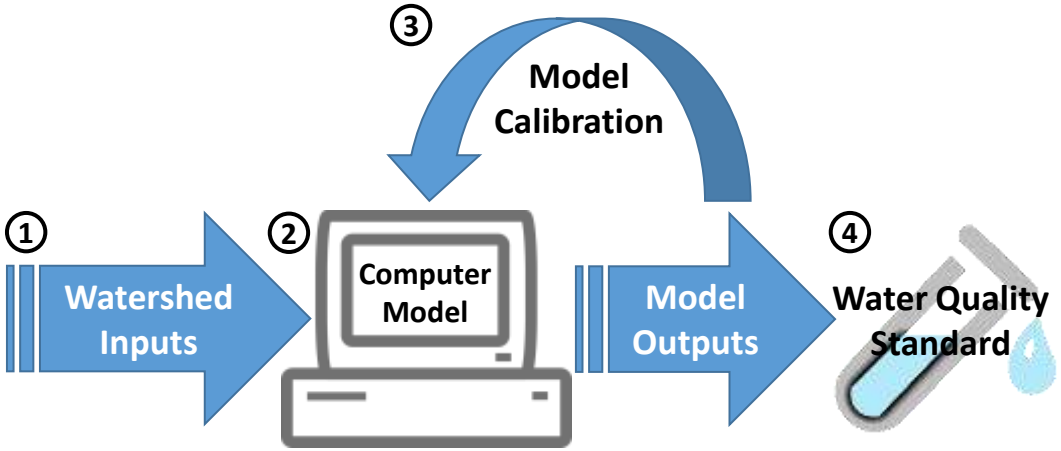

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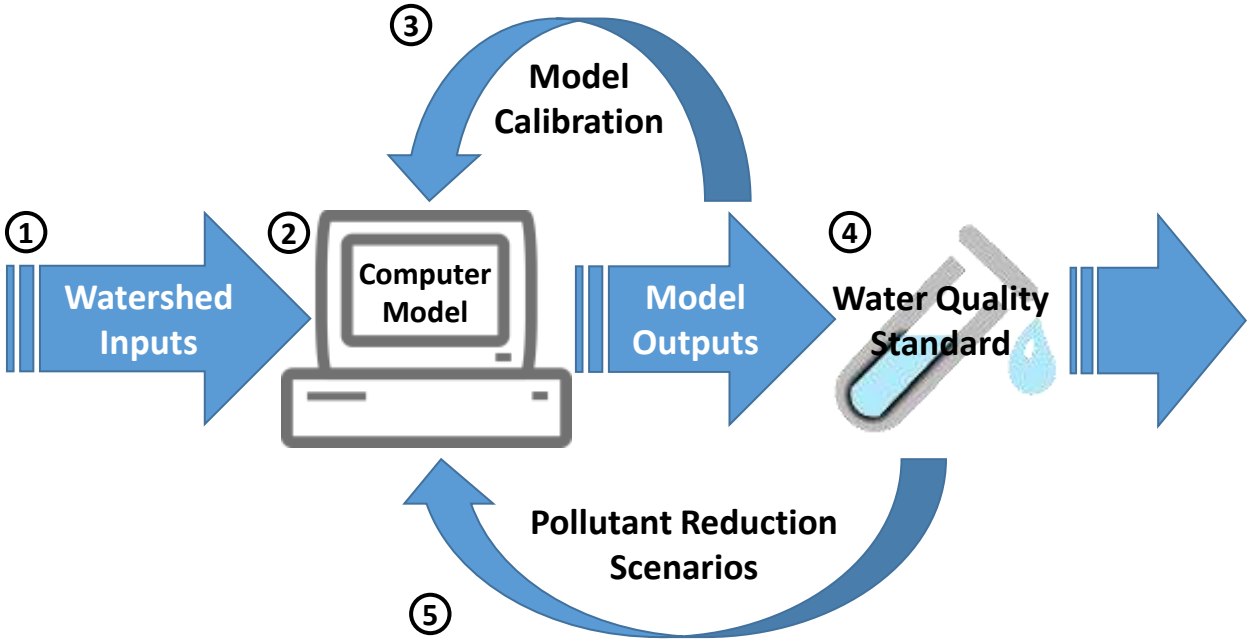

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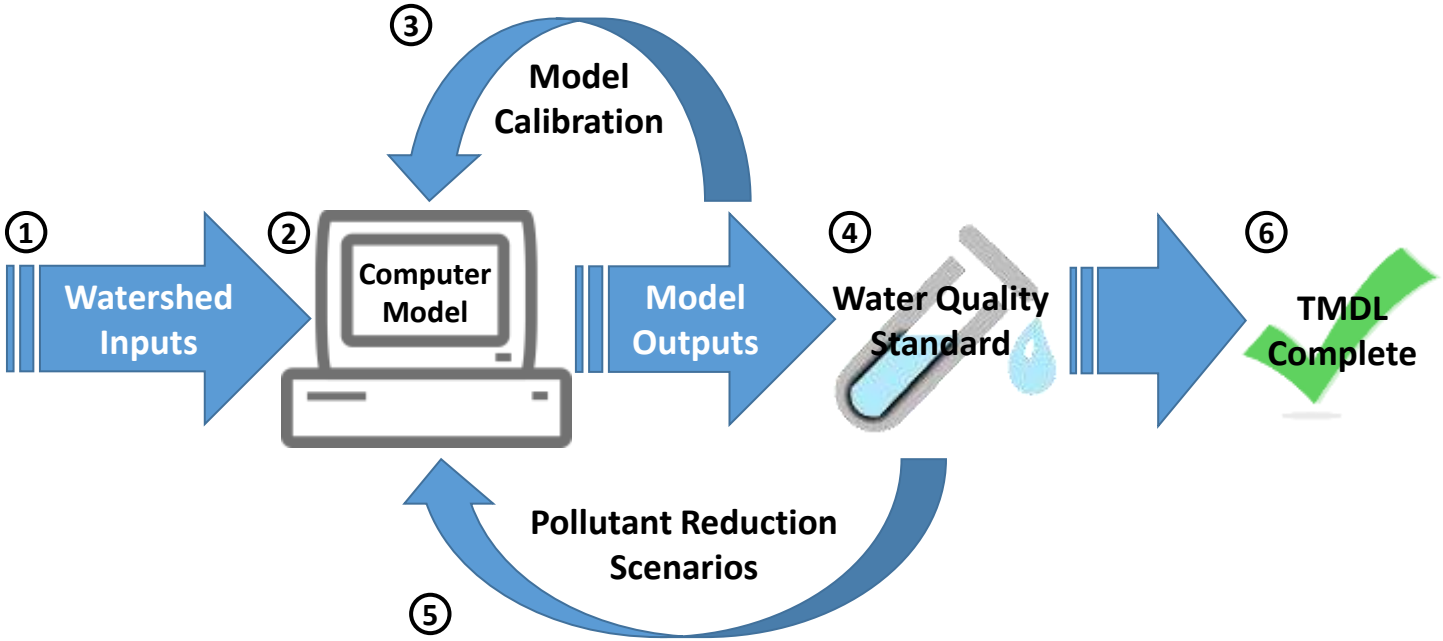

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6. Stakeholders select acceptable reduction scenario to achieve TMDL.

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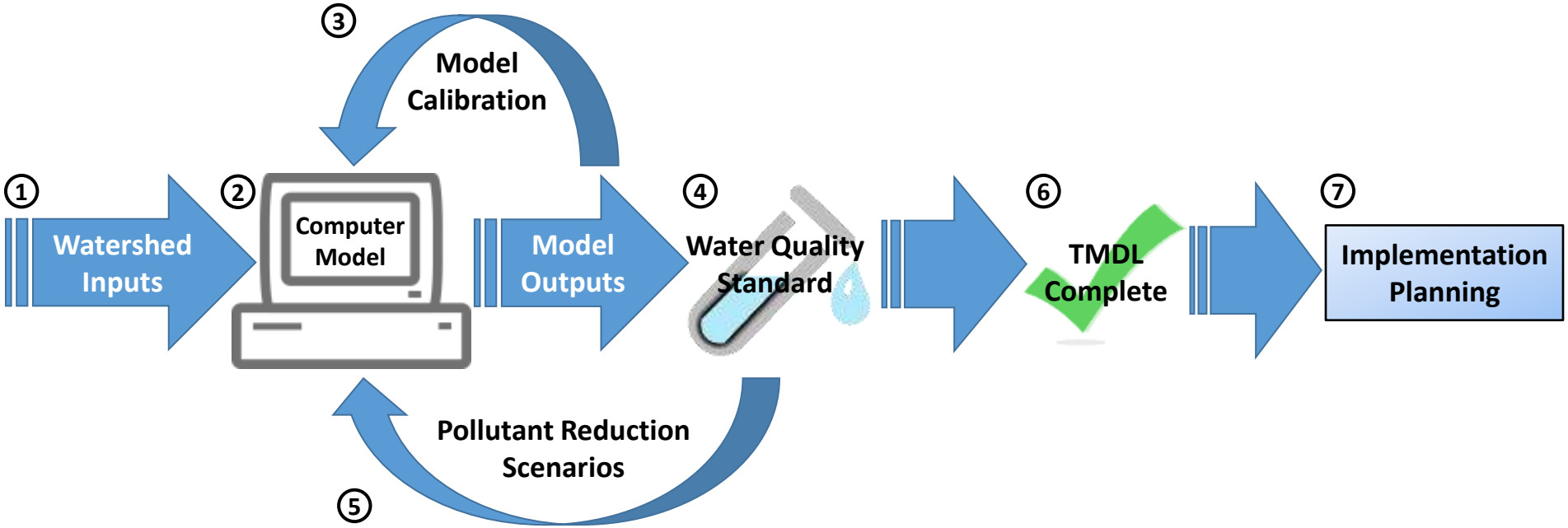


5. Model allows evaluation of multiple pollution reduction scenarios.
6. Stakeholders select acceptable reduction scenario to achieve TMDL.
7. Model output aids in developing plan to achieve pollutant reductions.

Model Inputs

- Watershed Inputs
  - Meteorological Data

https://commons.wikimedia.org/wiki/File:Weather_vane_2748.JPG

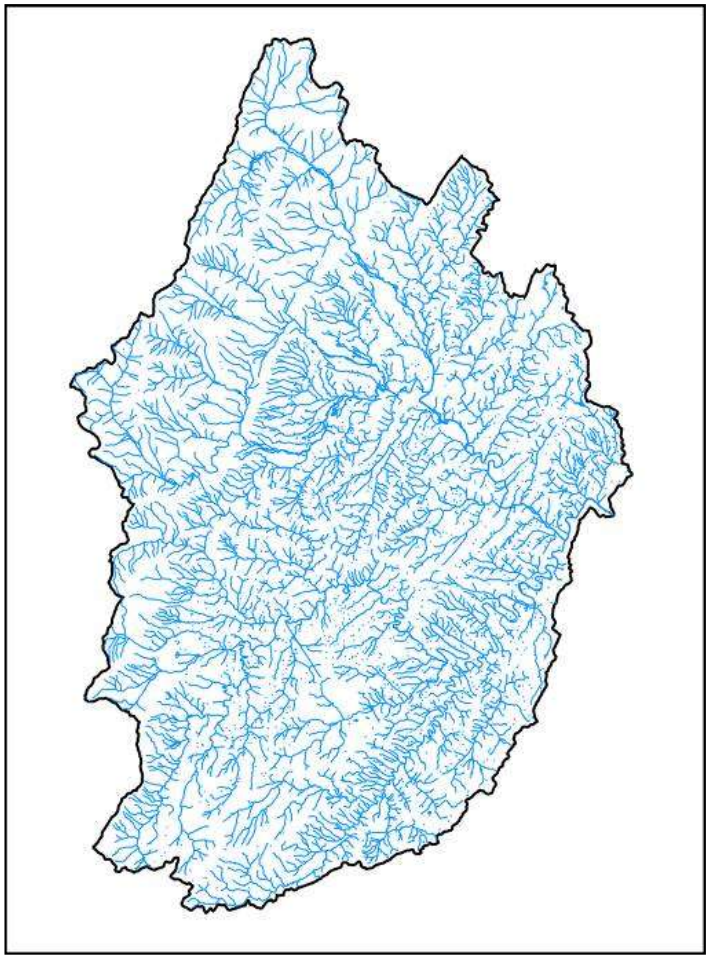
Model Inputs

- Watershed Inputs
  - Meteorological Data
  - Watershed Topography

Topo maps, Digital Elevation Models (DEMs)

Model Inputs

- Watershed Inputs
  - Meteorological Data
  - Watershed Topography
  - Stream Networks



National Hydrography Dataset (NHD)

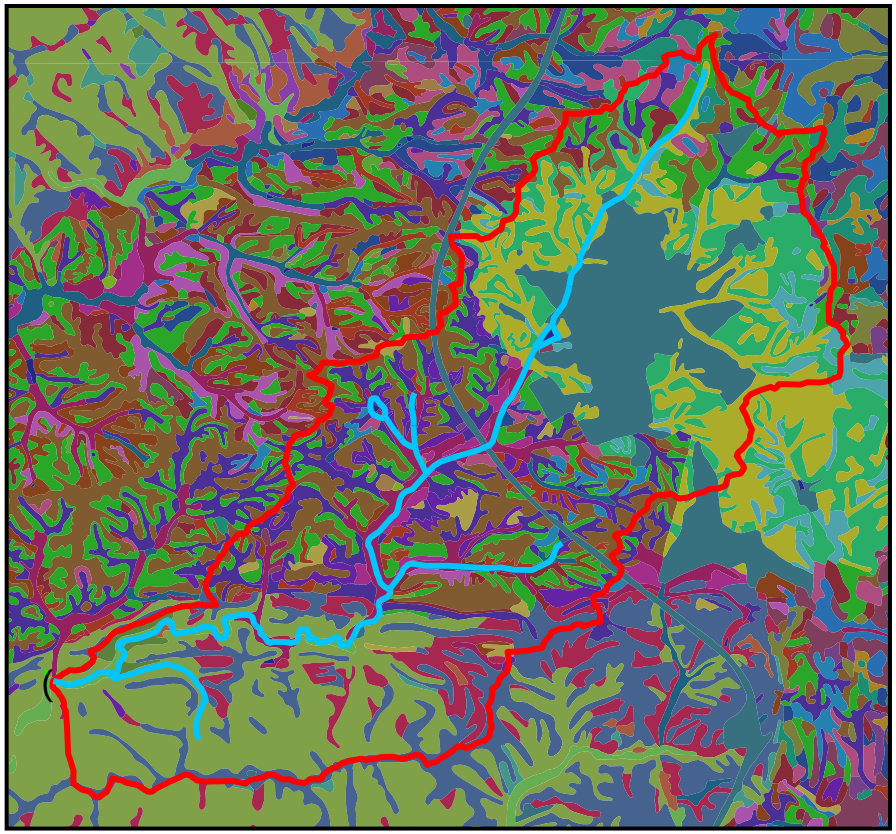
Model Inputs

- Watershed Inputs
  - Meteorological Data
  - Watershed Topography
  - Stream Networks
  - Land Use

http://www.mrlc.gov

Model Inputs

- Watershed Inputs
  - Meteorological Data
  - Watershed Topography
  - Stream Networks
  - Land Use
  - Soil Types



SSURGO Data, USDA-NRCS

PCB Sources

Permitted Facilities

- Municipal Wastewater Treatment Plants
- Industrial Stormwater General Permitted Facilities
- Industrial Facilities
- Modeled as point sources – sources with a defined outlet

Wastewater Treatment Plant

Contaminated Sites

- Former Manufacturing Facilities

Nanochemonics Site, Pulaski, VA (2013)

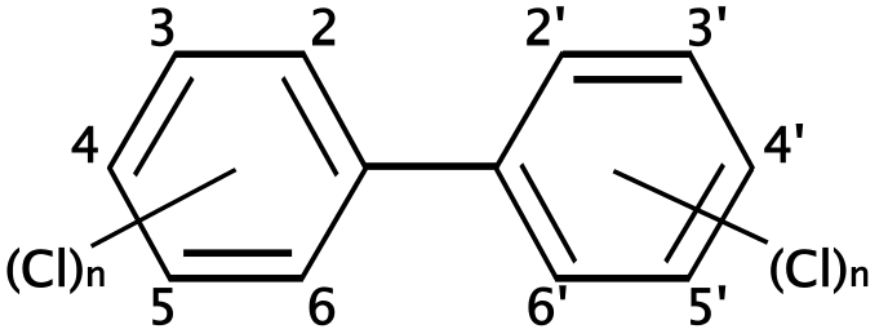
Contaminated Sites

- Former Manufacturing Facilities
- Rail Yards
- Soils have been exposed to PCBs
  - PCBs attach to the soil particles and wash off during precipitation events
- Modeled as nonpoint sources – diffuse sources (no clearly defined outlet)

Active Rail Yard

PCB Oil Spills

- Acute events in which PCBs are released into the environment
- May enter stream/river directly or may be spilled onto land surface
- Modeled as single event at specific date and time
- Event details available in Pollution Response Program (PReP) database



https://upload.wikimedia.org/wikipedia/commons/thumb/4/49/Polychlorinated_biphenyl_structure.svg/2000px-Polychlorinated_biphenyl_structure.svg.png

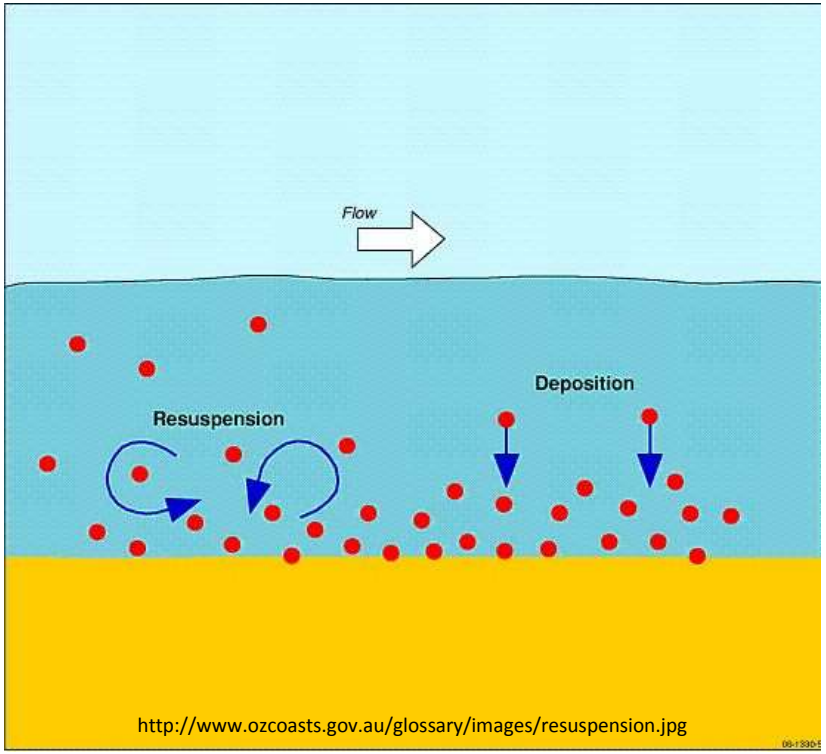
Atmospheric Deposition

- PCBs are present in the atmosphere in small concentrations
- They settle out from the atmosphere and are deposited on the land
- Modeled as a daily load of PCBs, applied to entire watershed surface area at a constant rate (1.6 µg/m^2)
- Considered a legacy source

http://www.pnnl.gov/science/images/highlights/atmospheric/atmosParticleWeightGain_580px.jpg

In-Stream Sediment

- PCBs that have attached to sediment and washed off the land surface may settle to the streambed and persist in the environment
- If the sediment is disturbed, the PCBs can be released into the water column
- Modeled as an initial concentration of PCBs attached to in-stream sediment
- Considered a legacy source

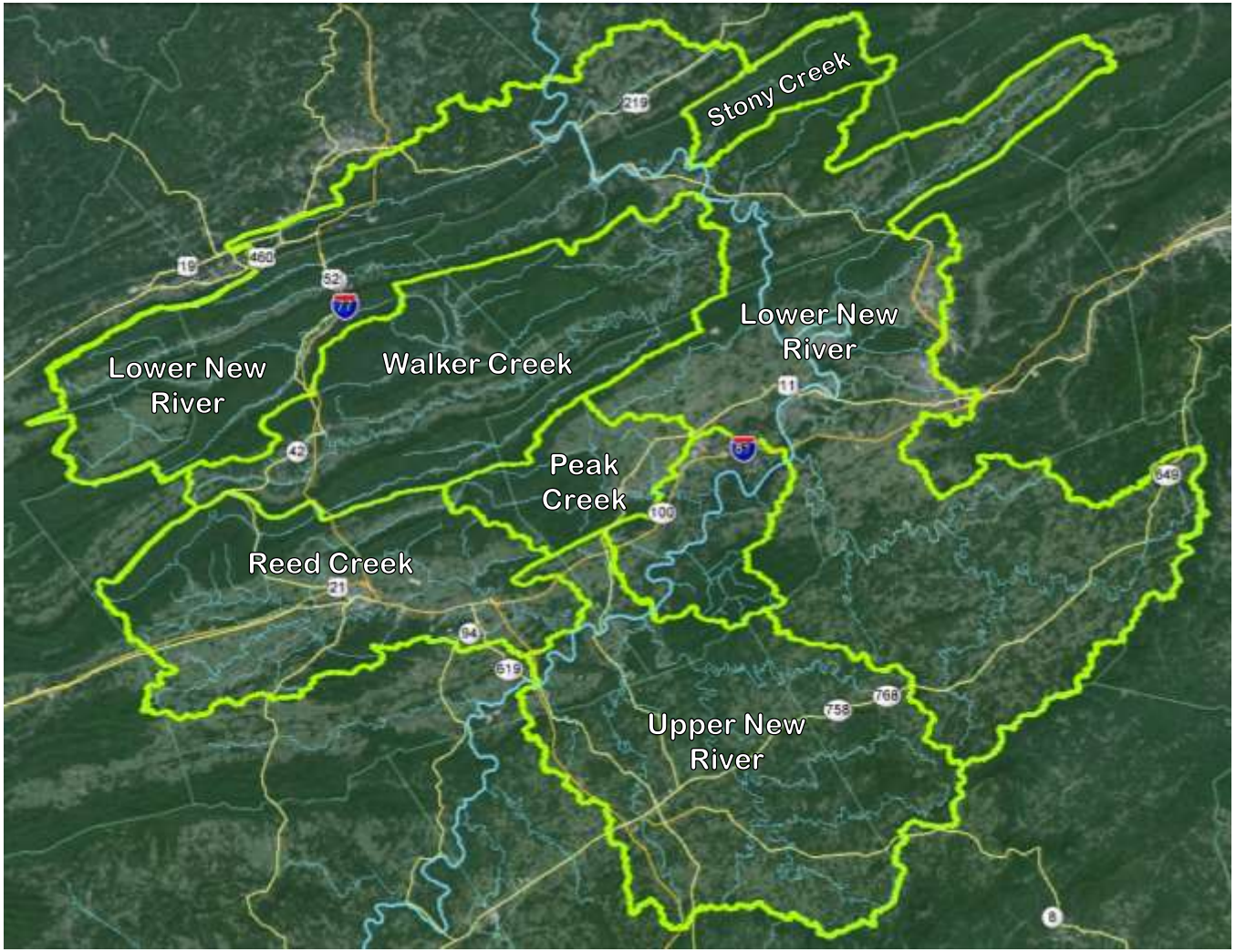


In-stream sediment resuspension and deposition

New River Watershed in Virginia

New River TMDL Study Area

Major Watershed Segments



Model Process

- New River model consists of

  3 major components:

  1. Hydrology
  2. Sediment
  3. PCB fate and transport

- Results calibrated against observed data:

  1. USGS stream flow data
  2. Suspended sediment concentration data
  3. PCB concentration data

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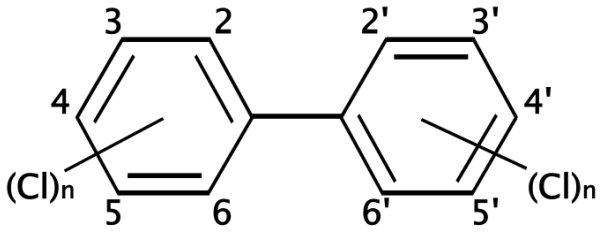
https://photogallery.sc.egov.usda.gov/netpub/server.np



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